



**PQ TEST  
AND  
FIRST 230 KV CABLE SYSTEM  
IN MEXICO**



- 
- *Jicable'15, 21 - 25 June 2015 - Versailles - France*

# TAT & PQT – 230 kV EHV Cable System: Standards

System Component ⇒ Tests ⇓	Cables	Terminations	Joints	Sheath Bonding / Grounding Systems
Routine	✓	✓	✓	✓
Sample	✓	✓	✓	✓
Type	✓ Mandatory for Systems 150< kV ≤500			
Prequalification – Complete System	✓ Mandatory for Systems 150< kV ≤500			
Extension of Prequalification – Complete System	✓ Mandatory for Systems 150< kV ≤500			
After Installation		✓		

Testing Requirements for HV & EHV Power Cable Systems 150< kV ≤500 (Ref: IEC 62067)

System Component ⇒ Tests ⇓	Cables	Terminations	Joints	Sheath Bonding / Grounding Systems
Production	✓	✓	✓	✓
Qualification (Type)	✓	✓	✓	✓
Qualification (Type) – Complete System	✓ Not mandatory for Systems 46< kV ≤150 ✓ Mandatory for Systems 150< kV ≤345			
Prequalification – Complete System	✓ Not mandatory for Systems 46< kV ≤150 ✓ Mandatory for Systems 150< kV ≤345			
After Installation			✓	

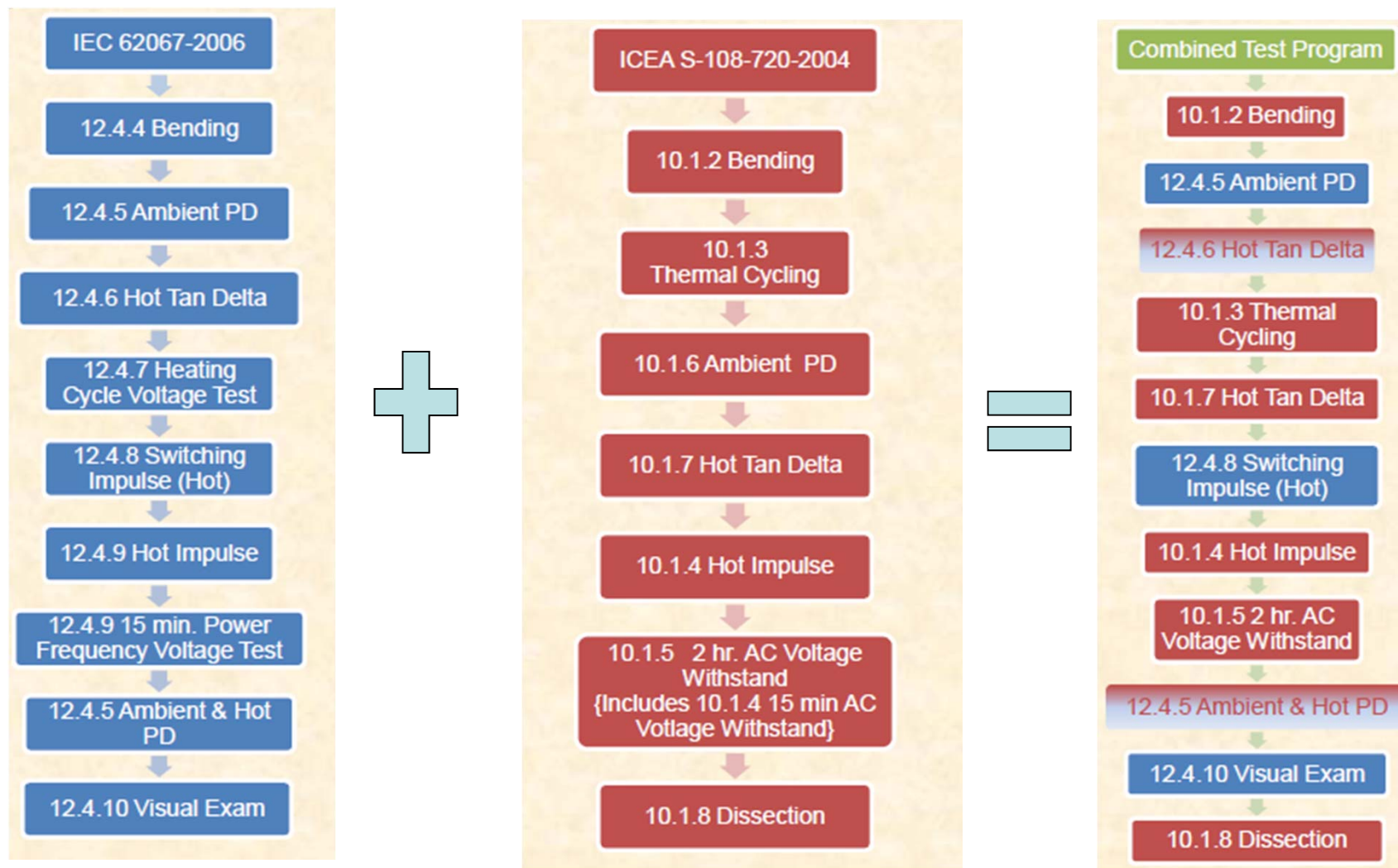
Testing Requirements for HV & EHV Power Cable Systems 46< kV ≤345 (Ref: AEIC CS9)

Tests ⇓	Cables
Production	✓
Qualification	✓

Testing Requirements for HV & EHV Power Cables 46< kV ≤345 (Ref: ICEA S-108-720)



# \*Test Program

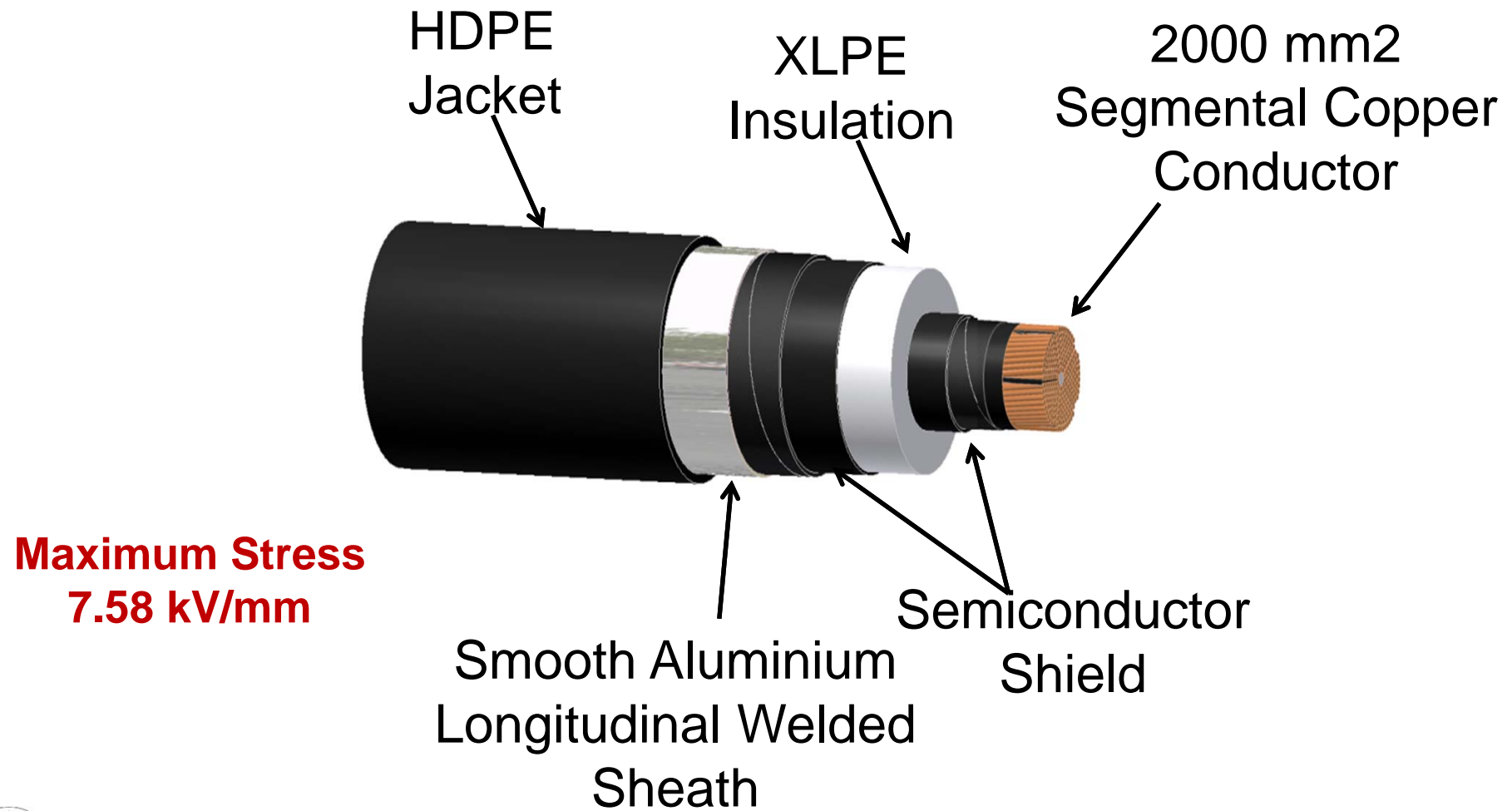


\*Source: Neetrac, Jicable'11.



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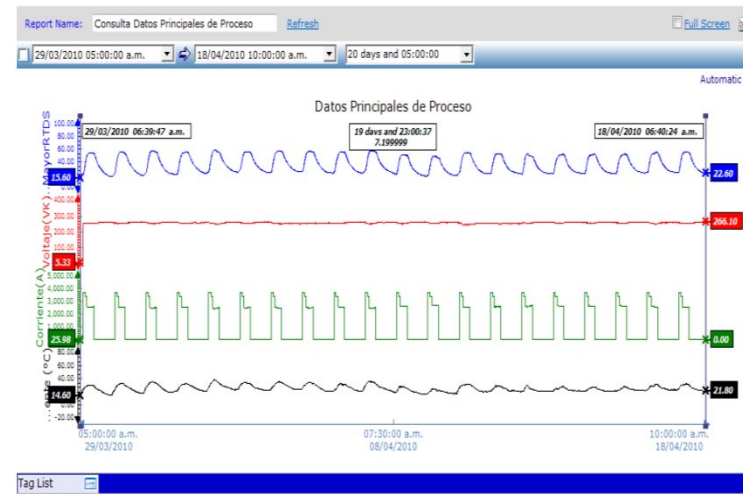
# Cable Design for Type and PQ Test 230 kV System



# IEC 62067 Type Test for 230 kV



SET UP LOOP – 20 DAYS @ 254 kV  
IMPULSE TEST  $\pm 10$  @ 1050 kV



180 HEATING CYCLES @ 95° C & 365 DAYS @ 216 kV

# AEIC CS9 & ICEA S-108-720 Type Test for 230 kV



SET UP LOOP – 20 DAYS @ 266 kV  
IMPULSE TEST  $\pm 10$  @ 1050 kV

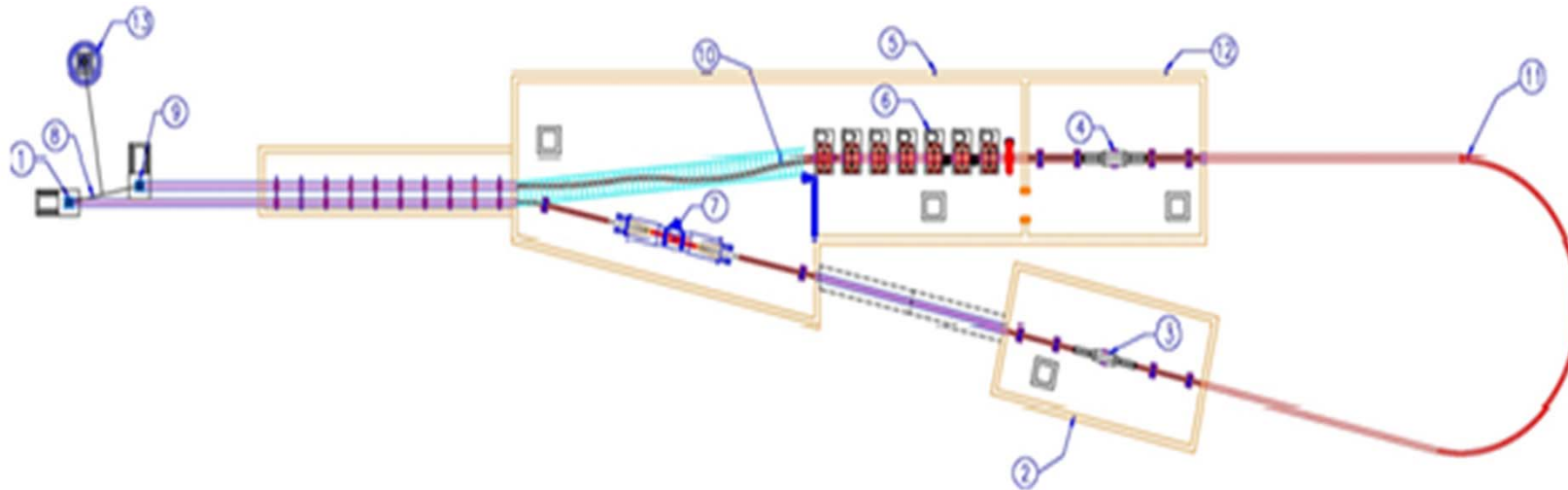


Additional 90 Cycles after IEC PQT @ 105° C & 226 kV





# PQT – 230 kV EHV Cable System



## PRINCIPAL DEVICES AND COMPONENTS

1. OUTDOOR PORCELAIN TERMINATION.

2. PIT FOR JOINT OPEN SCREEN.

3. CABLE JOINT TYPE SHIELD BREAK.

4. CABLE JOINT TYPE NO SHIELD BREAK.

5. PIT FOR TC'S.

6. CURRENT TRANSFORMERS FOR HEATING; 8

7. CABLE TERMINATION FOR GAS INSULATED SWITCHGEAR AND TRANSFORMER

8. COPPER BAR.

9. POLYMERIC TERMINATION..

10. CABLE 230 KV/1000 mm. ON 30 INCHES TRAY

11. CABLE 230 KV/2000 mm. DIRECTLY BURIED.

12. PIT FOR JOINT TYPE NO SHIELD BREAK.

13. LIGHTNING ARRESTER 400 KV.

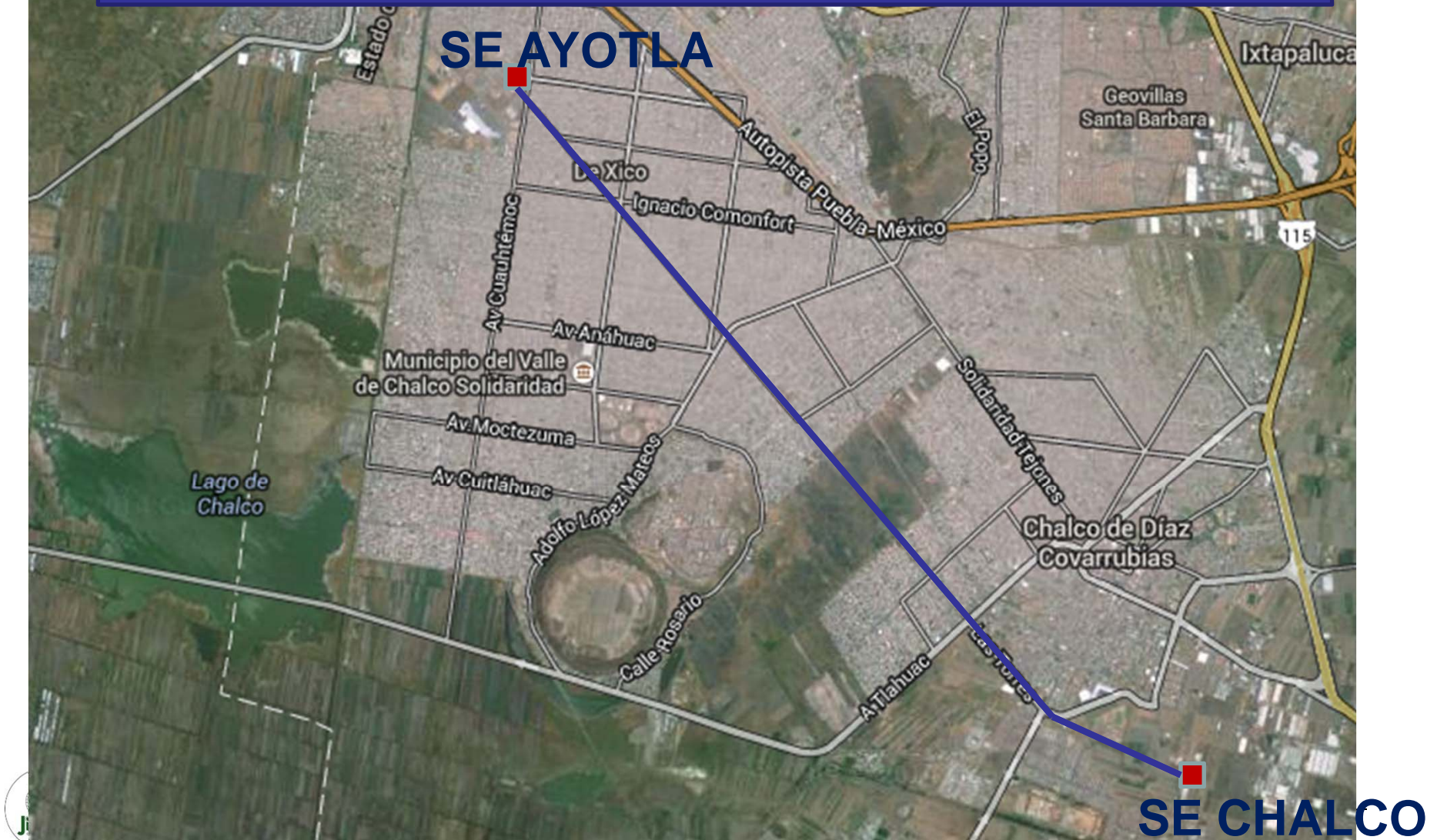
# FINAL REPORT

The 23.2 mm XLPE, 2000 mm<sup>2</sup> segmented copper conductor, underground transmission cable system from Viakable (see below) has successfully completed the following tests under the witnessing of NEETRAC & LAPTEM:

Type Approval to IEC62067 (Clause 12) at an operating temperature of 90 °C	<b>Complete 23 July 2010</b>
Type Approval to ICEA S-108-720-2004 at an emergency operating temperature of 105 °C	<b>Complete 8 June 2010</b>
Equivalency to AEIC CS9 (Section 6.0) at an emergency operating temperature of 105 °C	<b>Reported May 2011</b>
Pre Qualification to IEC62067 (Clause 13) at an operating temperature of 90 °C	<b>Complete 12 Oct 2011</b>
Pre Qualification to AEIC CS9 - 06 Clauses 7.0 and 1.9 at an emergency operating temperature of 105 °C	<b>Complete 8 Feb 2012</b>

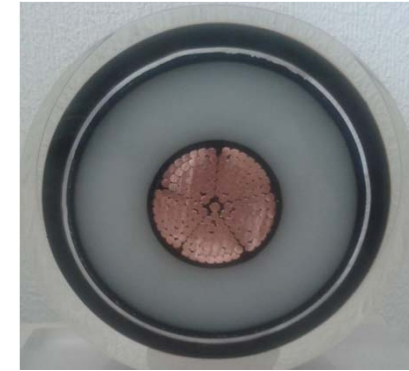


# AYOTLA-CHALCO 230 KV SYSTEM 1200 mm<sup>2</sup> Cu





# Characteristics of first 230 kV System with Mexican Power Cable



-29.7 km Total length

-One three phase circuit (9.9 km per phase)

-Ducts direct buried (Horizontal directional drill)

-39 Joints (break shield)

-6 Polymeric terminations

-754 m Length per reel

-Std IEC 62067

-1200 mm<sup>2</sup> Cu

-7.58 kV/mm Maximum Stress Design

-125 mm Overall Diameter

-22 kg/m Weight

-1090 A Current Rating



# Cable Installation



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# Terminations



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# Joins and Cross bonding boxes



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# After Installation Test



AC

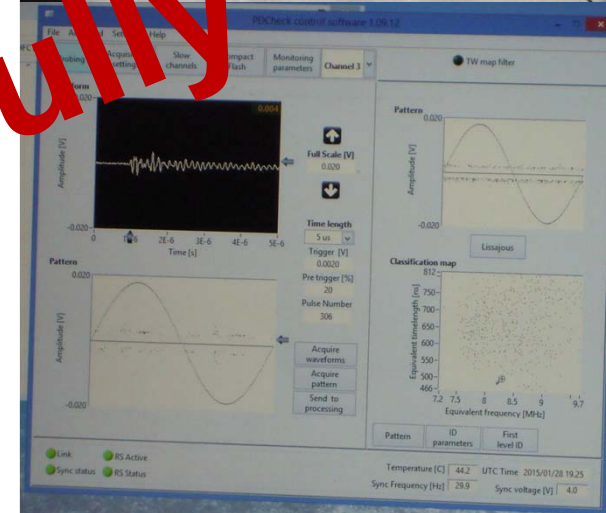
Vt=180 kV AC @ 1 h



PD

Measurement @ 120 kV and 180 kV

Successfully



# Conclusions

- ✓The combined program is an alternative method to test HV or EHV cable system for compliance the IEC and ICEA/AEIC standards. The combination of requirements are more rigorous.
- ✓The implementation by Viakable of the combined test program was successful and a big challenge.
- ✓The PD test after installation in the Ayotla-Chalco project is a precedent in the CFE power systems and will be a reference for future projects in Mexico.

